

CLAIMS

That which is claimed:

1. An anode for a secondary battery comprising a host material that is capable of absorbing and desorbing lithium in an electrochemical system and lithium metal dispersed in the host material.
2. The anode according to Claim 1, wherein the lithium metal is lithium powder.
3. The anode according to Claim 2, wherein the lithium powder has a mean particle size of less than about 20 microns.
4. The anode according to Claim 1, being capable of reversibly lithiating and delithiating at an electrochemical potential relative to lithium metal of from greater than 0.0 V to less than or equal to 1.5 V.
5. The anode according to Claim 1, wherein the host material comprises one or more materials capable of reversibly lithiating and delithiating at an electrochemical potential versus lithium of from greater than 0.0 V to less than or equal to 1.5 V.
6. The anode according to Claim 1, wherein the host material comprises one or more materials selected from the group consisting of carbonaceous materials, Si, Sn, tin oxides, composite tin alloys, transition metal oxides, lithium metal nitrides and lithium metal oxides.
7. The anode according to Claim 1, wherein the host material comprises a carbonaceous material.
8. The anode according to Claim 7, wherein the carbonaceous material is graphite.

9. The anode according to Claim 8, wherein the host material further comprises carbon black.
10. The anode according to Claim 1, wherein the amount of lithium metal in said anode is no more than the maximum amount sufficient to intercalate in, alloy with, or be absorbed by the host material in said anode when the anode is recharged.
11. A secondary battery including the anode of Claim 1.
12. A secondary battery comprising:
a positive electrode including an active material;
a negative electrode comprising a host material that is capable of absorbing and desorbing lithium in an electrochemical system and lithium metal dispersed in the host material;
a separator for separating the positive electrode and the negative electrode; and
an electrolyte in communication with the positive electrode and the negative electrode.
13. The secondary battery according to Claim 12, wherein the positive electrode includes a compound that can be lithiated at an electrochemical potential of 2.0 to 5.0V versus lithium as the active material.
14. The secondary battery according to Claim 13, wherein the active material in the positive electrode is selected from the group consisting of MnO_2 , V_2O_5 and MoS_2 , and mixtures thereof.
15. The secondary battery according to Claim 13, wherein the active material in the positive electrode comprises MnO_2 .
16. The secondary battery according to Claim 13, wherein the active material in the positive electrode is LiMn_2O_4 .

17. The secondary battery according to Claim 12, wherein the lithium metal in the negative electrode is lithium powder.

18. The secondary battery according to Claim 17, wherein the lithium powder in the negative electrode has a mean particle size of less than about 20 microns.

19. The secondary battery according to Claim 12, wherein the negative electrode is capable of reversibly lithiating and delithiating at an electrochemical potential relative to lithium metal of from greater than 0.0 V to less than or equal to 1.5 V.

20. The secondary battery according to Claim 12, wherein the host material in the negative electrode comprises one or more materials capable of reversibly lithiating and delithiating at an electrochemical potential versus lithium of from greater than 0.0 V to less than or equal to 1.5 V.

21. The secondary battery according to Claim 12, wherein the host material in the negative electrode comprises one or more materials selected from the group consisting of carbonaceous materials, Si, Sn, tin oxides, composite tin alloys, transition metal oxides, lithium metal nitrides and lithium metal oxides.

22. The secondary battery according to Claim 12, wherein the host material in the negative electrode comprises a carbonaceous material.

23. The secondary battery according to Claim 22, wherein the carbonaceous material is graphite.

24. The secondary battery according to Claim 23, wherein the host material further comprises carbon black.

25. The secondary battery according to Claim 12, wherein the amount of lithium metal in said negative electrode is no more than the maximum amount sufficient to intercalate in, alloy with, or be absorbed by the host material in said anode when said battery is recharged.

26. The secondary battery according to Claim 12, wherein the amount of active material in the positive electrode is sufficient to accept the removable lithium metal present in the negative electrode.

27. The secondary battery according to Claim 12, being in a fully charged state.

28. A method of preparing an anode for a secondary battery comprising:
providing a host material that is capable of absorbing and desorbing lithium in an electrochemical system;
dispersing lithium metal in the host material; and
forming the host material and the lithium metal dispersed therein into an anode.

29. The method according to Claim 28, wherein said dispersing step comprises mixing the lithium metal, the host material and a non-aqueous liquid together to form a slurry.

30. The method according to Claim 29, wherein said forming step comprising applying the slurry to a current collector and drying the slurry.

31. The method according to Claim 28, wherein said dispersing step comprises immersing the host material in a suspension containing lithium metal and a non-aqueous liquid.

32. The method according to Claim 31, wherein said dispersing step comprises immersing the host material in a suspension of lithium metal in a hydrocarbon.

33. The method according to Claim 28, wherein said dispersing step comprises dispersing a finely divided lithium metal powder in the host material.

34. The method according to Claim 33, wherein said dispersing step comprises dispersing lithium metal having a mean particle size of less than about 20 microns in the host material.

35. The method according to Claim 28, wherein said providing step includes providing a host material comprising one or more materials capable of reversibly lithiating and delithiating at an electrochemical potential versus lithium of from greater than 0.0 V to less than or equal to 1.5 V.

36. The method according to Claim 28, wherein said providing step comprises providing a host material comprising one or more materials selected from the group consisting of carbonaceous materials, Si, Sn, tin oxides, composite tin alloys, transition metal oxides, lithium metal nitrides, and lithium metal oxides.

37. The method according to Claim 28, wherein said providing step comprises providing a host material comprising a carbonaceous material.

38. The method according to Claim 37, wherein said providing step comprises providing a host material wherein the carbonaceous material is graphite.

39. The method according to Claim 38, wherein said providing step comprises providing a host material wherein the host material further comprises carbon black.

40. A method of operating a secondary battery comprising the steps of:
(a) providing a freshly prepared, secondary battery comprising a positive electrode including an active material, a negative electrode comprising a host material capable of absorbing

and desorbing lithium in an electrochemical system and lithium metal dispersed in the host material, a separator for separating the positive electrode and the negative electrode, and an electrolyte in communication with the positive electrode and the negative electrode;

(b) initially discharging the secondary battery by transmitting lithium ions from the negative electrode to the positive electrode through the electrolyte;

(c) charging the secondary battery by transmitting lithium ions from the positive electrode to the negative electrode through the electrolyte;

(d) discharging the secondary battery by transmitting lithium ions from the negative electrode to the positive electrode through the electrolyte;

(e) repeating steps (c) and (d).